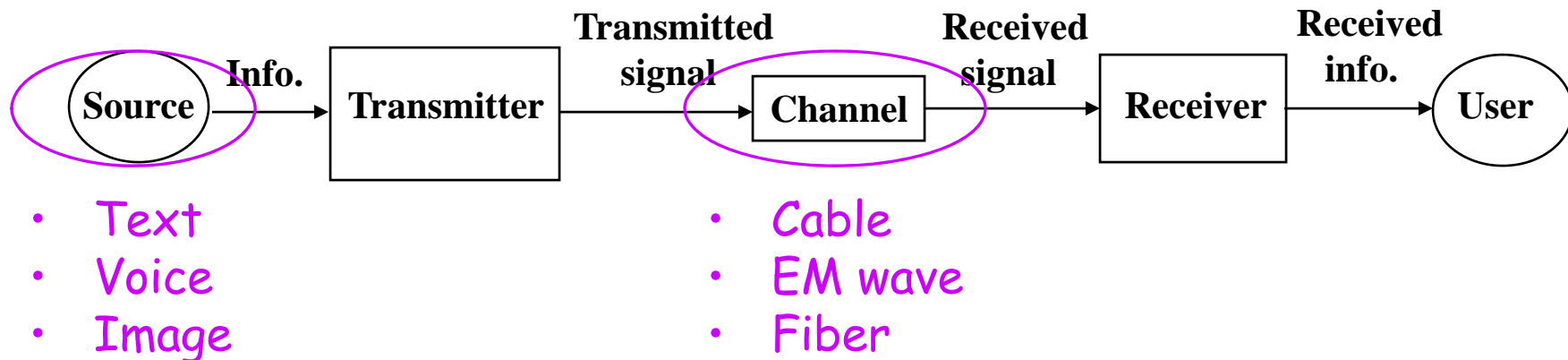


Principles of Communications

Lin DAI

Lecture 1. Overview of Communication Systems

Block Diagram of Communication Systems



- Transmitter: to **convert** the electrical signal into a form that is **suitable** for transmission
- Receiver: to **recover** the message contained in the **corrupted** received signal

Source and Channel of Communication Systems

Source

- Text, voice, images, ...
- How to model the source?
 - Analog System: How to represent the source information as a superposition of sinusoidal waves?
 - Digital System: How to represent the source information as a series of bits?

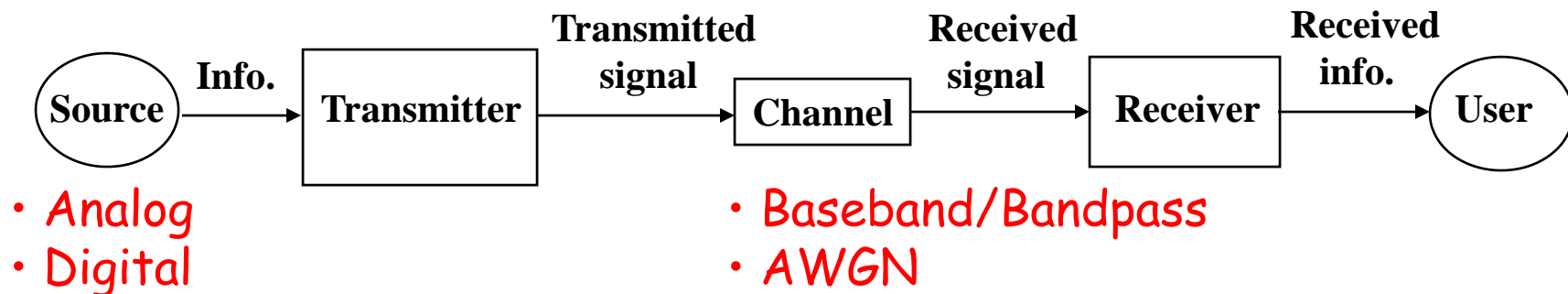
Channel

- Cable, EM wave, Fiber, ...
- How to model the channel?
 - Baseband/Bandpass Channel: How to properly modulate the signals to pass the channel without distortion?
 - Additive White Gaussian Noise (AWGN) Channel: How to properly demodulate the signals to remove the effect of noise?

Performance Metrics of Communication Systems

- Fidelity
 - It measures how accurate the received message is for given amount of transmission power.
- Spectral Efficiency (Bandwidth Efficiency)
 - It measures how efficient the spectrum is utilized.
- Complexity
 - The cost of complexity level changes over time.
 - It is a quantity that requires engineering judgement to estimate.

Course Organization

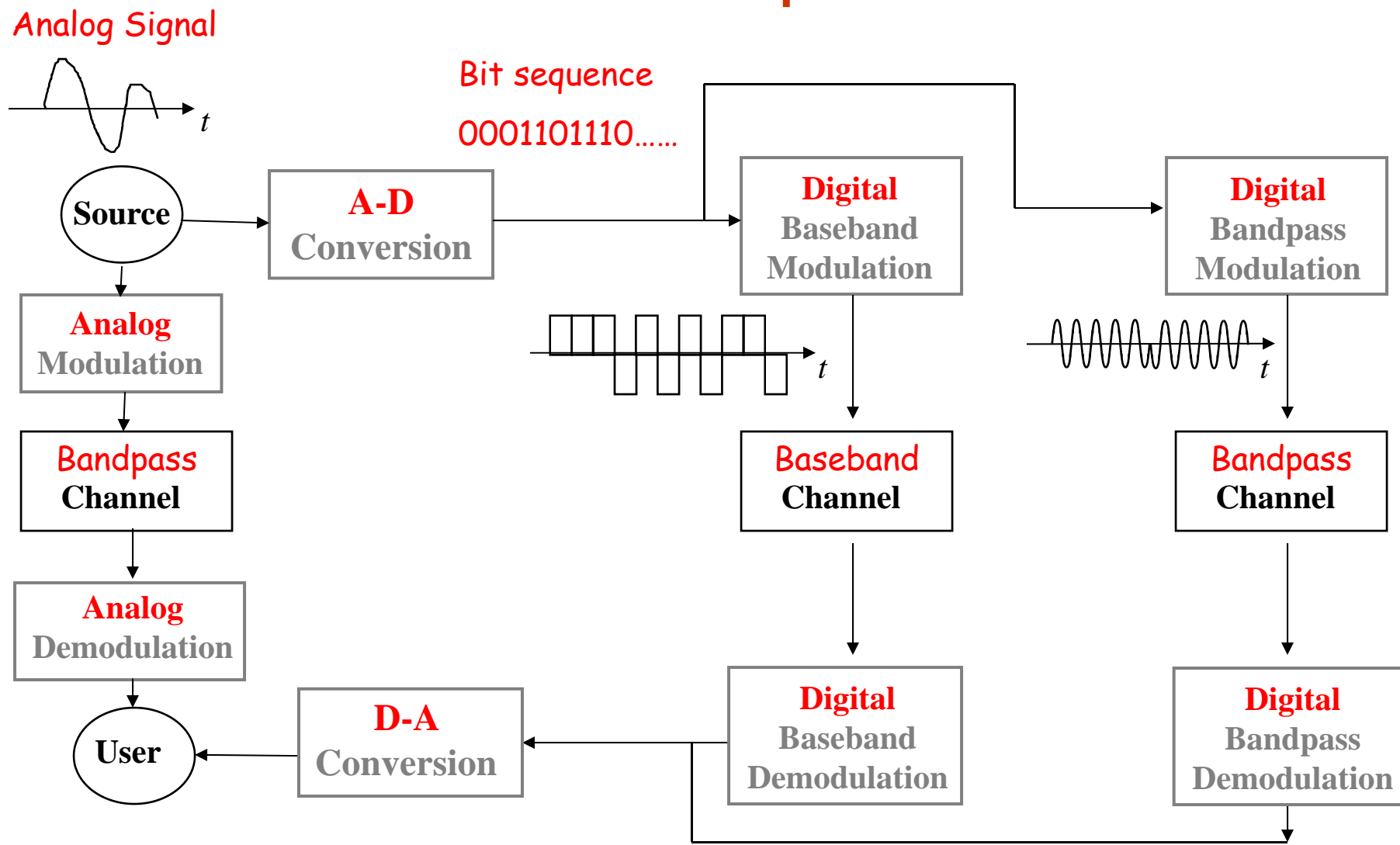


- ✓ How to model and characterize the analog and digital signals?
Lectures 2 and 5
- ✓ Why and how to modulate/demodulate an analog signal?
Lectures 3-4
- ✓ Why do we prefer digital signal transmission and how to convert an analog signal to a digital signal?
Lecture 6
- ✓ Why and how to modulate/demodulate a digital signal?
Lectures 7-8

Course Organization

- Week 2: Lecture 2 - Deterministic Signal Analysis
- Week 3: Lecture 3 - Analog Communications Part I: Amplitude Modulation
- Week 4: Lecture 4 - Analog Communications Part II: Frequency Modulation
- Week 5: Quiz 1 (Coverage: Lectures 1-4)
- Week 6: Lecture 5 - Random Signal Analysis
- Week 7: Lecture 6 - Digital Communications Part I: Sampling and Quantization
- Week 8-9: Lecture 7 - Digital Communications Part II: Digital Modulation
- Week 10: Quiz 2 (Coverage: Lectures 5-7)
- Week 11-12: Lecture 8 - Digital Communications Part III: Digital Demodulation
- Week 13: Quiz 3 (Coverage: Lectures 5-8)

Road Map



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- R. E. Ziemer and W. H. Tranter, *Principles of Communications: Systems, Modulation and Noise* (6th edition), John Wiley & Sons, 2010.
- B. P. Lathi and Z. Ding, *Modern Digital Analog Communication Systems* (4th edition), Oxford University Press, 2009.
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